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SUBJECT: Pesticides/PCBs Analysis of McNary Pool Fish

DATE: September 22, 1988

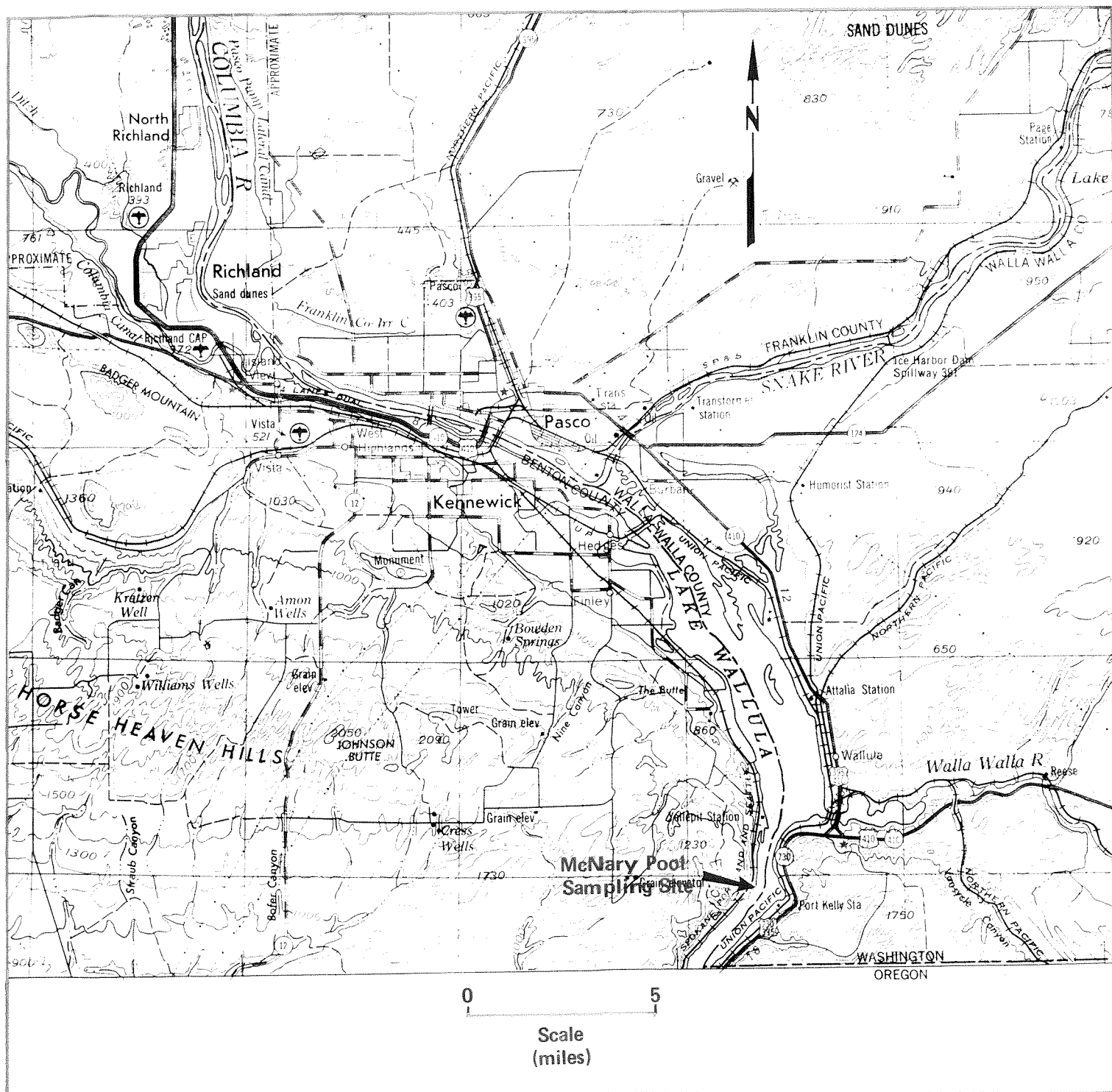
Abstract: EPA priority pollutant pesticides and PCBs were analyzed in samples of Columbia River white sturgeon (Acipenser transmontanus), channel catfish (Ictalurus punctatus) and other fish species collected from McNary Pool in 1987 and results compared to similar U.S. Fish and Wildlife Service (USFWS) data for white sturgeon collected in 1979. 1987 data indicate the level of contamination by DDT compounds (DDT, DDE and DDD) is substantially less than USFWS reported in 1979. Except for a trace of aldrin in one sample, PCBs and other chlorinated pesticides were not detected in 1987.

Introduction: Biologists at the U.S. Fish and Wildlife Service (USFWS) Marrowstone Island field station near Port Townsend reported high concentrations of DDE (to 8,510 ug/kg, wet-weight basis) and PCBs (to 5,330 ug/kg) in fillets from three Columbia River white sturgeon (Acipenser transmontanus) collected in 1979 from McNary Pool (Bosely and Gately, 1981). They further demonstrated a decreasing gradient in concentrations of these compounds in sturgeon from McNary Pool to the Columbia River estuary. This memorandum describes results of analysis of McNary Pool fish collected in August 1987 by the Ecology Water Quality Investigations Section (WQIS) to determine current levels of these contaminants.

Procedure: White sturgeon, channel catfish (Ictalurus punctatus), largescale sucker (Catostomus macrocheilus) and northern squawfish (Ptychocheilus oregonensis) were caught in a gill net set off the right bank of the Columbia River opposite Port Kelly Station the night of August 3rd (see figure). This is the site USFWS sampled in 1979. Only one sturgeon was caught in the gill net, and two set lines failed to catch any sturgeon. Specimens taken for analysis were wrapped in aluminum foil and placed on ice for transport to the Ecology/EPA Manchester laboratory.

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\*  
ug/kg = parts per billion



Sampling Location

Muscle and whole fish samples were prepared at Manchester and shipped by air freight to Enseco California Analytical Laboratory, West Sacramento, for analysis of the EPA priority pollutant pesticides and PCBs (Appendix A). Sample preparation and analysis followed the methods used for WQIS' 1985 survey of DDT compounds in the Yakima River drainage (Johnson et al., 1986). The accuracy of the data was assessed by duplicate matrix spikes (Appendix B).

Discussion: DDT, DDE, DDD, and aldrin were the only pesticides detected in McNary Pool fish (Table 1). Detection limits for other chlorinated pesticides and PCBs were 20 - 40 ug/kg and 200 - 400 ug/kg, respectively (Appendix A).

The total DDT concentration (t-DDT, the sum of DDT and metabolites DDE and DDD) in the muscle tissue of the single sturgeon obtained was 470 ug/kg; channel catfish muscle had t-DDT concentrations of 92 - 420 ug/kg. A trace of aldrin (4.6 ug/kg) was detected in one catfish muscle sample. Concentrations of t-DDT in whole fish were 860 - 960 ug/kg in largescale sucker and 400 ug/kg in northern squawfish.

Table 2 compares the data on t-DDT concentrations measured in muscle tissue of McNary Pool fish collected in 1979 and 1987. Because accumulation of DDT compounds in fish is primarily a function of the amount of fat in the tissues, t-DDT concentrations were normalized to lipid content to better compare samples with different amounts of lipid.

Concentrations of t-DDT in the muscle tissue of McNary Pool sturgeon and catfish collected in 1987 were an order of magnitude lower, on both a wet- and lipid-weight basis, than USFWS measured in sturgeon collected in 1979. USFWS reported trace amounts (less than 120 ug/kg) of dieldrin, hexachlorobenzene, alpha-hexachlorocyclohexane (BHC), beta-nonachlor, trans-nonachlor, alpha-chlordane and gamma chlordane in muscle and/or liver tissue of the 1979 sturgeon. None of these compounds were detected in 1987.

One source of DDT compounds to this reach of the Columbia is the Yakima River (confluence at river mile 335). Table 3 summarizes results of priority pollutant pesticides analysis of whole fish collected from the Yakima during the WQIS 1985 survey. The level of t-DDT in McNary Pool fish resembles that in the middle reaches of the Yakima (Wymer and Buena stations). Noteworthy differences between the Yakima and McNary Pool fish include higher concentrations of DDT relative to its metabolites and detection of dieldrin, endosulfan, and endrin in Yakima fish.

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\* Endrin aldehyde, chlordane, and toxaphene detection limits were 200 to 400 ug/kg.

Other data on levels of DDT compounds in whole Columbia River fish are limited,\*to results of the USFWS National Contaminant Biomonitoring Program (Schmitt et al., 1985). These data are also summarized in Table 2 and compared to the McNary Pool results for whole fish. These limited data suggest accumulation of DDT compounds by fish in this approximately 450-mile reach of the Columbia takes place primarily between Grand Coulee Dam and McNary Pool. The reason for the discrepancy apparent in the level of contamination in samples of whole common carp and yellow perch collected at Pasco (river mile 328) in 1980 and muscle tissue samples from sturgeon collected from McNary Pool (river mile 312) in 1979 is not known.

The detection of DDT compounds in fish is not unusual. USFWS found DDT or its metabolites in at least one sample from each of the 107 stations sampled nation-wide in 1980-81 (Schmitt et al. 1985). The significance of the concentrations observed in McNary Pool fish can be gauged by comparison to the U.S. Food and Drug Administration (FDA, 1985) "action level" for maximum t-DDT in the edible tissue of commercially marketed fish (5,000 ug/kg) and National Academy of Sciences (NAS, 1973) recommendations for maximum t-DDT concentrations in whole fish for protection of aquatic life and wildlife (1,000 ug/kg).

In summary, results from analysis of limited numbers of McNary Pool fish collected in 1987 indicate the level of contamination by organochlorine compounds is substantially less than USFWS reported in 1979 and is presently within generally accepted criteria for protection of human health, aquatic life, and wildlife.

AJ:cp

Attachments

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\* Formerly the National Pesticide Monitoring Program.

#### REFERENCES

- Bosley, C. E. and G. F. Gately, 1981. Polychlorinated biphenyls and chlorinated pesticides in Columbia River white sturgeon (Acipenser transmontanus). USFWS, Marrowstone Field Station, Nordland, WA.
- FDA, 1985. Action levels for poisonous or deleterious substances in human food and animal feed. Center for Food Safety and Applied Nutrition, Industry Programs Branch, Washington D.C. 13pp.
- Johnson, A., D. Norton, and B. Yake, 1986. Occurrence and significance of DDT compounds and other contaminants in fish, water, and sediment from the Yakima River basin. Washington State Dept. of Ecology, 86-5, 69pp.+ appendices.
- NAS, 1973. Water Quality Criteria-1972. EPA.R3.73.033. 594pp.
- Schmitt, C.J., J.L. Zajicek, and M.A. Ribik, 1985. National pesticide monitoring program: residues of organochlorine chemicals in freshwater fish, 1980-81. Arch. Environ. Contam. Toxicol. 14:225-260.

Table 1. Concentrations of DDT and metabolites measured in McNary Pool fish collected August 3-4, 1987 (ug/kg<sup>a</sup>, wet).

Species	Fork Length (mm)	Weight (gms)	Sample Number	Percent Dry Weight	Percent Lipid		p,p'-DDT	p,p'-DDE	p,p'-DDD	b	
										t-DDT	
MUSCLE TISSUE											
White sturgeon	934 <sup>c</sup>	--	8340	27	8.1	35	340		94		470
Channel catfish	512	2075	8341	25	5.4	14	170		33		220
(QA duplicate of sample no. 8341)			8342	23	5.4	12	49		31		92
Channel catfish	498	1950	8343	24	6.7	13	220		28		260
Channel catfish	494	1347	8344	16	NA <sup>e</sup>	10	360		48		420
WHOLE FISH											
Largescale sucker	417	1037	8345	31	16	52	650		160		860
(composite of 2 individuals)	460	1425									
(QA duplicate of sample no. 8345)			8346	32	15	50	750		160		960
Northern squawfish	327	445	8347	24	4.8	ND <sup>f</sup>	400		ND		400
(composite of 2 individuals)	344	508									

<sup>a</sup>ug/kg = parts per billion

<sup>b</sup>t-DDT = DDT + DDE + DDD; sum rounded to significant figures

<sup>c</sup>total length

<sup>d</sup>aldrin detected in this sample at 4.6 ug/Kg

<sup>e</sup>not analyzed

<sup>f</sup>not detected, see Appendix A

Table 2. Summary of data on t-DDT in fish collected in McNary Pool (Columbia River @ Port Kelly Station) and other parts of the Columbia River (ug/kg, wet).

Location	Year	Approx. River Mile	Species	Number of Samples	t-DDT Concentration			Reference
					Wet-weight Basis	Lipid-weight Basis		
						MUSCLE TISSUE		
Columbia River @ Port Kelly Station	1979	312	White sturgeon	3	5,500 (980-9,500) <sup>a</sup>	94,000 (41,000-160,000)	Bosley & Gately (1981)	
	1987	312	White sturgeon	1	470	5,800	present survey	
	1987	312	Channel catfish	3	280 (160 <sup>b</sup> -420)	5,200 (1,700-6,900 <sup>c</sup> )	present survey	
WHOLE FISH								
Columbia River @ Grand Coulee	1980	596	Largescale sucker	2 <sup>d</sup>	100 (80-130)	1,500 (1,300-1,500)	Schmitt <u>et al.</u> , (1985)	
	1980	596	Walleye	1 <sup>d</sup>	30	830	Schmitt <u>et al.</u> , (1985)	
Columbia River @ Pasco	1980	328	Common carp	2 <sup>d</sup>	230 (220-240)	6,400 (5,400-7,500)	Schmitt <u>et al.</u> , (1985)	
	1980	328	Yellow perch	1 <sup>d</sup>	330	8,700	Schmitt <u>et al.</u> , (1985)	
Columbia River @ Port Kelly Station	1987	312	Largescale sucker	1 <sup>d</sup>	910 <sup>b</sup>	5,900 <sup>b</sup>	present survey	
	1987	312	Northern squawfish	1 <sup>d</sup>	400	8,300	present survey	
Columbia River @ Cascade Locks	1980	149	Largescale sucker	2 <sup>d</sup>	800 (760-840)	6,100 (6,000-6,300)	Schmitt <u>et al.</u> , (1985)	
	1980	149	Northern squawfish	1 <sup>d</sup>	780	12,000	Schmitt <u>et al.</u> , (1985)	

<sup>a</sup>mean (range)

<sup>b</sup>average of duplicates

<sup>c</sup>calculated using average lipid in other McNary catfish samples

<sup>d</sup>composite samples

Table 3. Summary of data on chlorinated pesticides in samples<sup>a</sup> of whole fish collected from the Yakima River in 1985 (ug/kg, wet).

Location	Approx. River Mile	Species	Percent Lipid	p,p'-DDT	p,p'-DDE	p,p'-DDD	t-DDT	Dieldrin	Endosulfan	Endrin
Yakima River @ Cle Elum	179-181	Mountain whitefish	11.5	ND <sup>b</sup>	50	ND	50	ND	ND	ND
Yakima River @ Wyer	134-136	Mountain whitefish	12.0	ND	280	ND	280	90	ND	ND
Yakima River @ Buena	93-95	Bridgelip sucker	6.6	ND	80	ND	80	ND	ND	ND
		Northern squawfish	3.7	ND	560	ND	560	ND	ND	ND
		Mountain whitefish	11.7	80	550	ND	630	ND	170	ND
		Mountain whitefish	12.8	110	540	ND	650	ND	140	ND
Yakima River @ Kiona	20-23	Suckers (mixed spp.)	8.4	120	370	ND	490	20	50	50
		Suckers (mixed spp.)	10.0	80	210	ND	290	40	ND	20
		Northern squawfish	3.7	ND	890	ND	890	ND	ND	ND
Yakima River @ Kiona	20-23	Largescale sucker	11.1	90	830	140	1,100 <sup>c</sup>	240	ND	ND
		Northern squawfish	5.5	ND	2,900	130	3,000	90	ND	ND

Source: Johnson et al., (1986)

<sup>a</sup>each sample a composite of 2-3 individuals

<sup>b</sup>not detected at 20-40 ug/kg detection limit

<sup>c</sup>includes 30 ug/kg o,p'-DDE

Appendix A. Organochlorines analyzed in McNary Pool fish and associated detection limits (ug/kg, wet).

<u>Organochlorines Analyzed</u>	<u>Detection Limits</u>
alpha-BHC	20
beta-BHC	20
delta-BHC	20
gamma-BHC (Lindane)	20
Heptachlor	20
Aldrin	20
Heptachlor epoxide	20
Endosulfan I	20
Dieldrin	40
p,p'-DDE	40
Endrin	40
Endosulfan II	40
p,p'-DDD	40
Endosulfan sulfate	40
p,p'-DDT	40
Methoxychlor	40
Endrin aldehyde	200
Chlordane	200
Toxaphene	400
PCB-1016	200
PCB-1242	200
PCB-1248	200
PCB-1254	400
PCB-1260	400

Appendix B. Matrix spike/matrix spike duplicate recoveries in fish tissue<sup>a</sup> (ug/kg).

<u>Compound</u>	<u>Spiked</u>	<u>Found (MS1)</u>	<u>Found (MS2)</u>	<u>Average Percent Recovery</u>
Lindane	20	0	0	0 <sup>b</sup>
Heptachlor	20	22	16.3	96
Aldrin	20	19.5	18.8	96
Dieldrin	50	36.3	36.4	73
Endrin	50	38.6	39.4	78
DDT	50	62.8	75.5	139
PCB-1260	1,000	738	986	86

<sup>a</sup> whole largescale sucker

<sup>b</sup> laboratory attributed spike loss to interferences and dilution